



Community Storage -The Path Forward! Ice Batteries

April 3, 2017

PROPRIETARY & CONFIDENTIAL



Introduction to Ice Energy

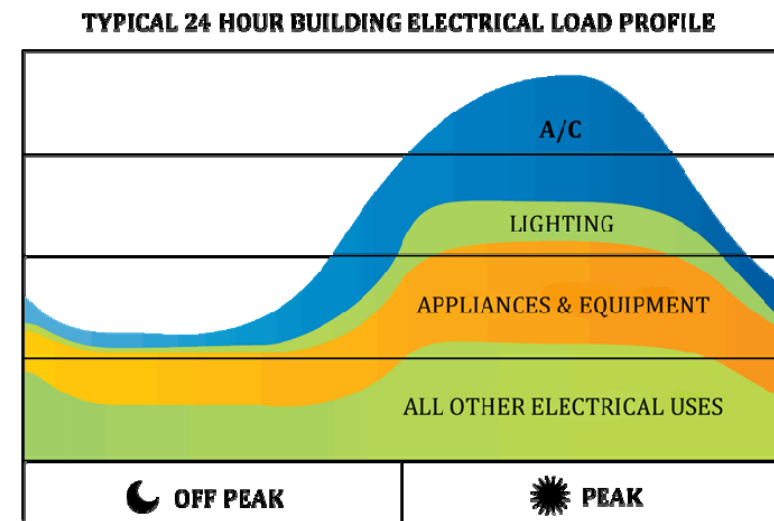
- Thermal energy storage company founded in 2003 and a pioneer in community storage
- Headquartered in Santa Barbara California
- Dedicated to turning biggest problem for the electricity grid – air conditioners – into lowest cost, most reliable and easiest way to get a lot of energy storage onto the grid fast, which is needed to make our grid efficient, reliable and able to replace fossil fuels with renewables

The grid's problem with air conditioning

AC is the principal contributor to peak demand

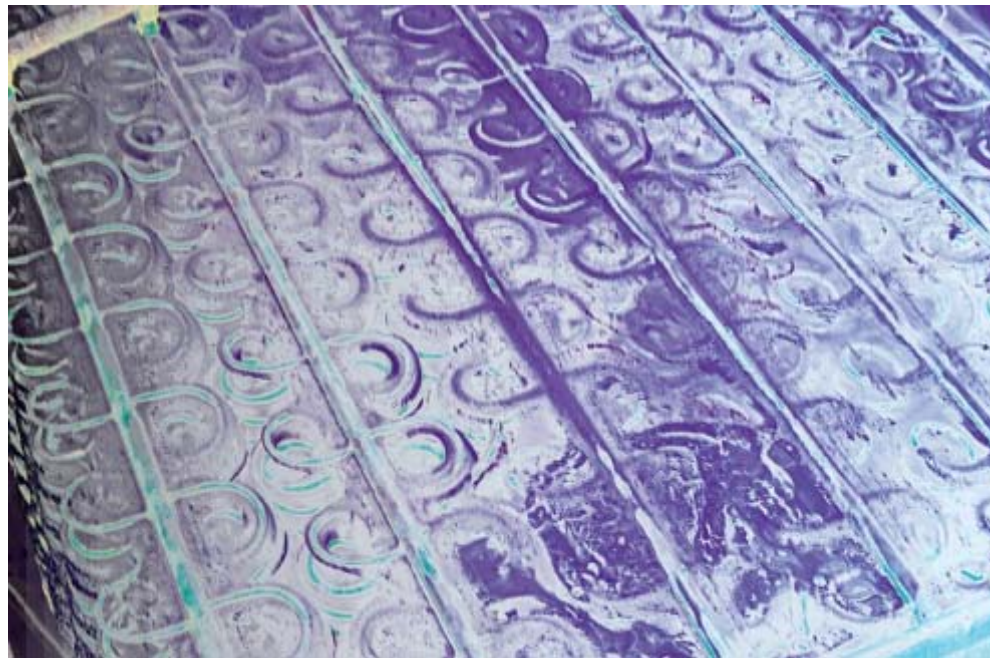
Peak demand:

- Requires overbuilding the grid
- Increases risk of blackouts
- Requires gas peaking plants



Ice batteries

- We set out to make an ice storage system for air conditioners that would eliminate their peak demand by making cooling off-peak, storing it as ice and delivering it on peak just by letting the ice melt



Ice Bear 30

1. ICE BATTERY

A system of copper coils pumps cold refrigerant through regular tap water to make ice when desired (typically at night when electricity is abundant).

2. MONITORING AND CONTROLS

The Ice Bear's award-winning smart grid technology seamlessly monitors the cooling process, providing full visibility and control to the utility / project owner.

3. ICE BEAR COOLING SYSTEM

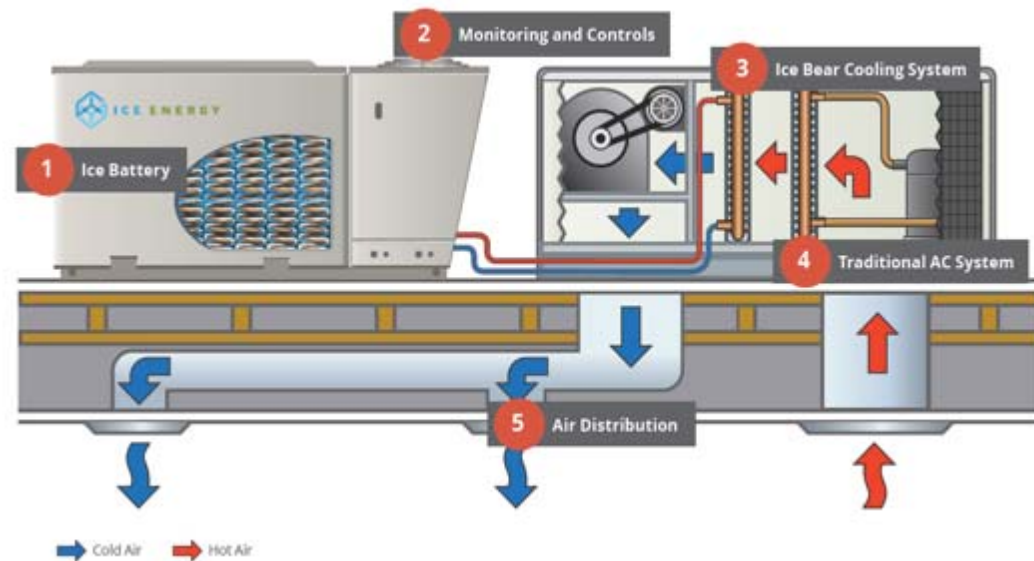
When dispatched to reduce peak demand, the Ice Bear turns off the compressor of the AC unit and uses the ice produced off-peak to efficiently provide exactly the same level of cooling for the building.

4. TRADITIONAL AC SYSTEM

The Ice Bear connects directly to a 5-20 ton rooftop AC unit, providing 3 to 6 hours of energy-efficient cooling during peak hours. If needed, the existing AC cools the building during off-peak hours.

5. AIR DISTRIBUTION

By using existing ducting to distribute cooled air, there are no costly ductwork retrofits.



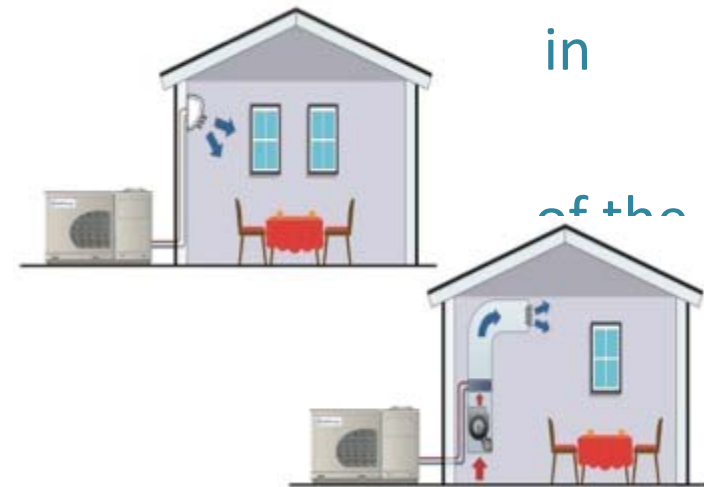
Example installation – Ice Bear 30

Municipal building Redding, CA operational since 2010



Ice Bear 20

- Residential unit for larger homes
- Optimized for utilities to deploy congested parts of their grid
- Based on the core technology Ice Bear 30 but
 - Replaces the AC unit



Ice Cub

- Residential unit for smaller homes
- Optimized for homeowners/builders
- Fast charge for solar pv over-gen
- Heat pump option replaces furnace



Solving the Duck Curve

The Duck Curve

- Caused by residential solar PV
- Destabilizing
- Residential doesn't respond to rates like C&I

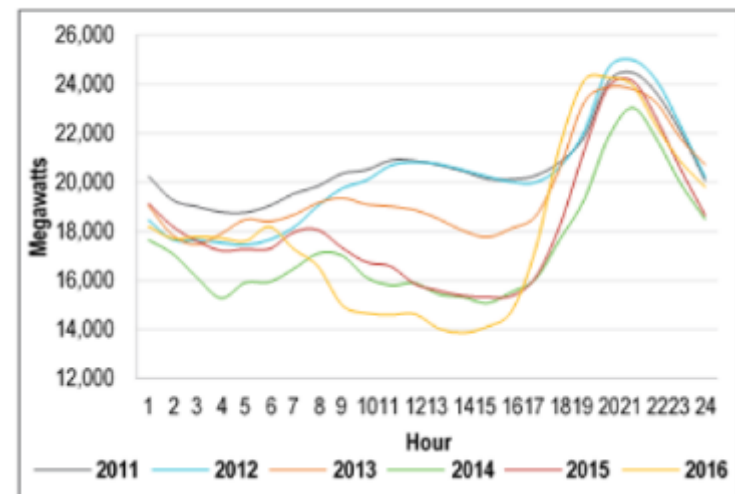
Hawaii is the canary

- Threatens further solar adoption

Storage is the solution

- Big opportunity for the right technologies
- Thermal storage a natural part of the solution
- Homes will flatten their own load

Figure 2: Lowest March Daytime Net Load, 2011–2016



Ice battery advantages

Lowest cost – less than ½ the cost of lithium-ion

Most reliable - 98%+ availability over 34 million operating hours

Environmentally Friendly & Safe – unlike chemical batteries, no heat or hazardous material spillage / disposal risks. Storage medium tap water, filled once. All parts recyclable.

20 year life – unlike chemical batteries no repowers, no cycling limitations. no degradation

Fast deployment – no complex interconnection and permitting, only building permit

High efficiency - 100% effective efficiency, 85% round-trip efficiency

Example Ice Bear Project: Redding CA

Purpose: Defer need for 45 MW gas peaker

Project size: 1 MW/year since 2012 - ongoing

Utility Sponsor: Redding Electric, who owns and dispatches the Ice Bear units

Community Participants: Utility's C&I customers with aging AC units

Participant benefits: Free Ice Bears. discounted AC replacement, lower utility bill

Example Ice Bear Project: Riverside CA

Purpose: Defer feeder upgrades

Project size: 1 MW/year since 2016 - ongoing

Utility Sponsor: Riverside Public Utilities, who owns and dispatches the Ice Bear units

Community Participants: Utility's C&I customers on designated feeders with aging AC units

Participant benefits: Free Ice Bears, discounted AC replacement, lower utility bill

Example Ice Bear Project: SoCal Edison

Purpose: Defer new substation

Project size: 26 MWs installed over 4 years

Utility Sponsor: SoCal Edison who will receive storage services under a 20 year PPA

Community Participants: Utility's C&I customers in Orange County with aging AC units

Participant benefits: Free Ice Bears, discounted AC replacement, lower utility bill